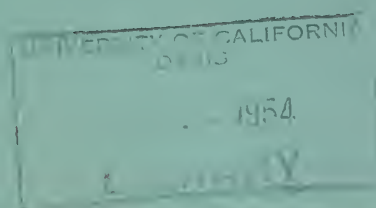


STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

BARITE DEPOSITS NEAR BARSTOW
SAN BERNARDINO COUNTY
CALIFORNIA

SPECIAL REPORT 39



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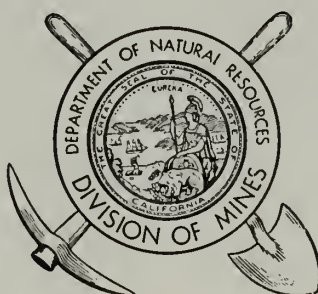
SPECIAL REPORT 39

APRIL 1954

BARITE DEPOSITS NEAR BARSTOW

SAN BERNARDINO COUNTY CALIFORNIA

By CORDELL DURRELL
Geological Survey, U. S. Department of the Interior



Price 50¢

BARITE DEPOSITS NEAR BARSTOW, SAN BERNARDINO COUNTY, CALIFORNIA *

BY CORDELL DURRELL **

OUTLINE OF REPORT

	Page
General statement -----	3
Ball barite deposit -----	3
Barite deposits in the vicinity of the Barium Queen mine -----	4
Hansen barite deposit and vicinity -----	5
Barite deposits at the Lead Mountain mine and vicinity -----	7
Selected references -----	8

Illustrations

Plate 1. Map of Ball barite deposit, San Bernardino County, California -----	In pocket
2. Map of Barium Queen mine and vicinity, San Bernardino County, California -----	In pocket
3. Map of Hansen barite deposit, Ludlow, San Bernardino County, California -----	In pocket
4. Map of Lead Mountain and vicinity, San Bernardino County, California -----	In pocket
Figure 1. Index map of barite deposits near Barstow, San Bernardino County, California -----	4

GENERAL STATEMENT

The material in this report was compiled from field studies made of barite deposits during the latter part of World War II. The work was done as a part of the Strategic Minerals Investigations carried on by the U. S. Geological Survey. No prior reports on the deposits have been published; however, all the deposits are briefly referred to in mineral resource reports of the California Division of Mines.

Four localities are described in this report: the Ball barite deposit, barite veins in the vicinity of the Barium Queen mine, the Hansen barite deposit, and barite deposits at the Lead Mountain mine and vicinity. These deposits have been grouped together in one report because all are in the vicinity of Barstow, California, and, with the exception of the Hansen deposit, within a few miles of one another; all are vein deposits; and the pattern of future exploration and mining would be similar for each deposit. The individual deposits have been treated separately in this report, as each is unique in structural, stratigraphic, and mineralogic relationships and each has been exploited to a different degree.

The writer wishes to acknowledge the courtesies shown him by the owners of the properties. A. C. Daley ably assisted in the field and in the preparation of the illustrations.

BALL BARITE DEPOSIT

The Ball barite deposit is about 15 miles northeast of Barstow in the SE $\frac{1}{4}$ sec. 8, T. 11 N., R. 1 E., San Bernardino County, California (fig. 1). It is at the western end of the Calico Mountains and half a mile west of the paved road connecting Barstow and Camp Irwin. The property consists of two claims, held in 1945 by O. H. Ball of Los Angeles. A brief description of the property is given by Tucker and Sampson (1943).

Geology. The rocks exposed in the vicinity of the Ball barite deposit consist of a thick sequence of pre-Cretaceous metamorphosed sedimentary and volcanic

rocks, a small area of tuff of Tertiary age, and Recent alluvial deposits (pl. 1). The rocks trend northward; from west to east they consist of an unknown thickness of metamorphosed clastic sedimentary rocks, chert, limestone, siliceous tuff and flows; a belt of marble about 200 feet thick in which the barite occurs; a belt of slates, quartzites, and siliceous tuffs about 130 feet thick; and an unknown thickness of metamorphosed basic volcanic rocks, dark schists, and interbedded slates.

The rock in which the barite occurs consists of a ramifying network of calcite veins and irregular masses of white marble in gray schistose marble. The white marble probably resulted from recrystallization, either by contact or by hydrothermal metamorphism, of the gray marble. Veins and pods of tremolite fill cross faults in the marble and are found along the fault near the west edge of the belt (pl. 1). The tremolite probably resulted from hydrothermal metamorphism.

The rocks exposed east of the marble are dark-colored blastoporphyratic amphibolites, hornblende and chlorite schists, and thin beds of slates and light-colored schists. The dark schists were probably formed by dynamothermal metamorphism of flows and tuffs that were andesitic to basaltic in composition. The thin slates and light-colored schists are believed to have been formed from the metamorphism of interbedded clastic sedimentary rocks and rhyolitic tuffs. These rocks are continuously exposed for a distance of half a mile to the east; farther eastward they are covered by alluvium.

Unmetamorphosed tuff overlies the dark schists near the southern edge of the mapped area. The tuff is cream-colored, thin-bedded, and fine-grained; rhyolitic; and probably Miocene in age.

The rocks in the area trend northward and generally dip 50° to 60° E. To the east, the marble appears to be conformable with the beds but to the west it is bordered by a fault. The fault trends northward and dips at about the same angle as the bedding, but the fact that the beds beneath the fault are successively cut out to the north indicates discordance. The magnitude of this fault is not known. Many cross faults cut the marble and offset the main north-trending fault, and several of these cross faults terminate against it. It is probable that all of the faults are of the same relative age; and, as both the main fault and many of the smaller faults contain tremolite, the faulting occurred about the same time as the tremolitization, or earlier.

Barite Veins. The barite occurs in veins in the marble east of the main north-trending fault in a zone that is nowhere more than 70 feet wide. The barite is fine-grained and massive. The amount of impurities present in the veins is small, and the barite, upon weathering, develops only a faint brown iron stain. The veins are a fraction of an inch to 2 feet wide. They trend northward and dip 14° to 57° E. Cross faults have cut the veins, brecciating the barite into angular blocks that later were recemented by granular calcite. The age of emplacement of the barite is not known; however, the emplacement occurred before the cross faulting and tremolitization.

* Publication authorized by the Director, U. S. Geological Survey.
** Geologist, U. S. Geological Survey. Manuscript submitted for publication August, 1953.

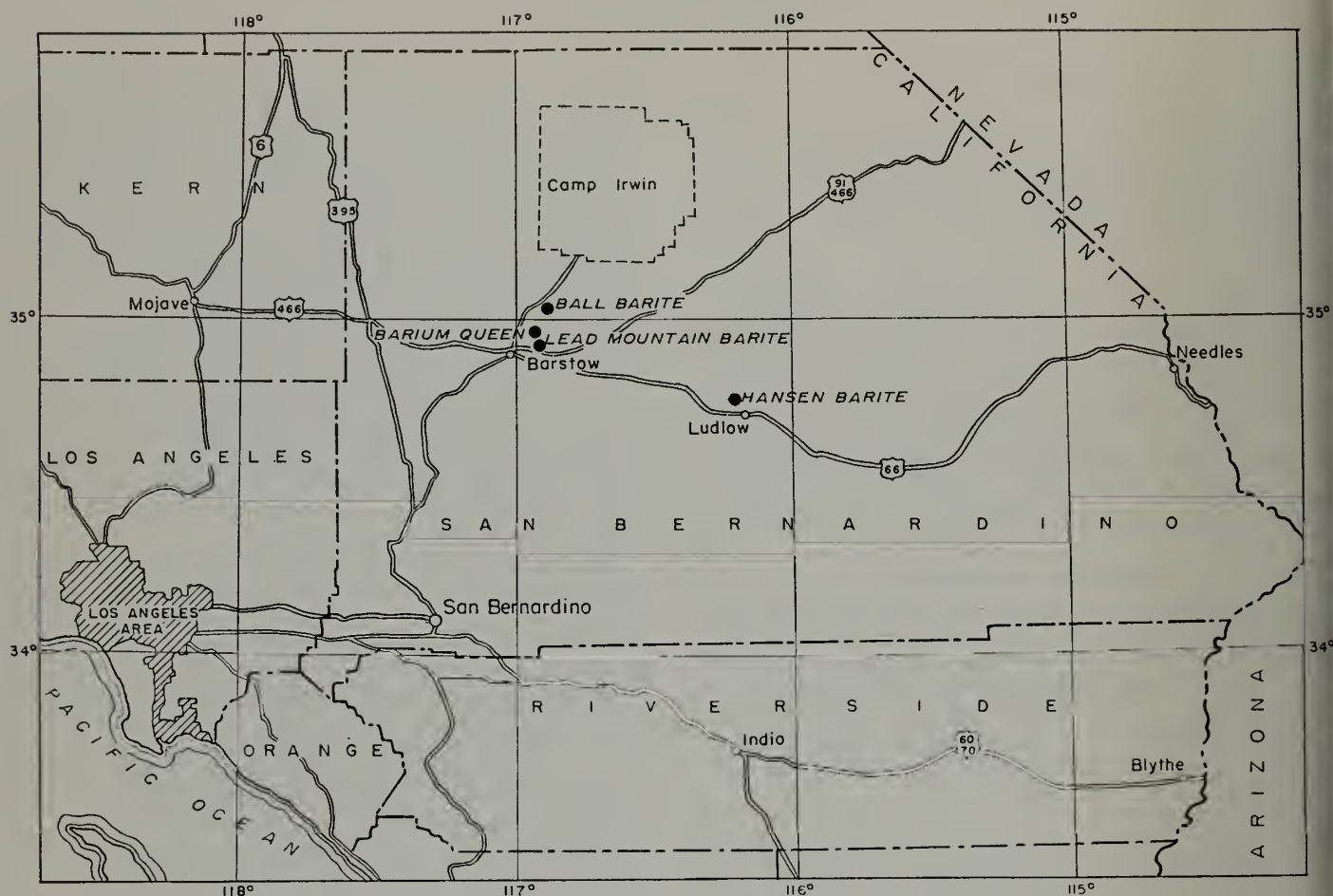


FIGURE 1. Index map of barite deposits near Barstow, San Bernardino County, California.

North of the mapped area the marble is partly silicified and has been replaced by predominantly brown but also yellow and red chalcidony and microcrystalline quartz. The silicified zone was traced for a mile to the north, where the marble is covered by alluvium. Similar silicified marble was traced for half a mile to the south, the limit of exposure of the beds. Silicified marble is rare near the barite veins, and nowhere has barite been found in association with the silicified rock.

The silicification is believed to have occurred during Tertiary time and is probably related to the silver-lead-zinc mineralization of the Calico Mountains and the surrounding country. Many of the low-grade Tertiary silver veins in the region to the south contain barite; however, the barite differs in occurrence and association from that in the veins of the Ball deposit.

Workings. The two claims covering the Ball deposit were filed in July, 1941. Subsequently 11 open-cuts and two 10-foot adits were made on the property. It is estimated that about 500 tons of barite was obtained from the larger cut in the southern area near the end of the road. The amount of barite quarried from the large cut at the extreme southern end of the workings, although substantial, was probably not as great. None of the other cuts have yielded important amounts of barite.

Reserves. As may be seen on the accompanying map (pl. 1), the barite veins are very thin. Near the center of

the southern workings a vein 1 foot thick crops out but this thickness is maintained for only about 30 feet along the strike. The only veins wide enough to warrant attention are those that have been quarried at the big cut near the end of the road in the central part of the southern workings. Here surface mining is no longer practicable, and it would be necessary to begin underground workings. The maximum thickness of the barite in these veins is 4 feet, but the average thickness for a length of 70 feet is not more than 2 feet. In addition there is no indication that the veins widen or even continue in depth. The known minable reserve of barite is small in the present state of development of the deposit.

BARITE DEPOSITS IN THE VICINITY OF THE BARIUM QUEEN MINE

The Barium Queen mine is about 5 miles northeast of Barstow, in San Bernardino County, California (fig. 1), near the east end of a low range of hills. The mine is in the NE $\frac{1}{4}$ sec. 27, T. 10 N., R. 1 W. From a point southeast of the mine the barite-bearing veins extend northwestward into secs. 21, 22, and 28 of the same township. The area is accessible from both the north and the south by good ungraded roads.

Six claims along the three principal veins were patented in 1906 by Charles Mushrush. In 1945 the three western claims were owned by the State of California and the three eastern claims, known from north to south as the Barium Queen, the White House, and the White

House Extension, were owned by Justin Snow of Los Angeles.

Brief descriptions of the Barium Queen mine are given by Bradley (1930, pp. 54-55) and Tucker and Sampson (1931, p. 137; 1943, pp. 508-509) in reports of the California Division of Mines.

Geology. Biotite-hornblende gneiss is the principal rock in the area. Northwest of the Barium Queen mine, however, are interbedded layers of fine conglomerate, pebbly quartzite, and a bed of marble 25 feet wide (pl. 2). The presence of these metasedimentary rocks in the gneiss suggests that the gneiss was derived by metamorphism of sedimentary rocks. Several small pegmatites and a granitic dike, too small to be shown on the map, crop out in the area. The age of the rocks is not known.

Bedding planes were found only near the marble, but a well-developed cleavage was mapped in both the marble and the gneiss. This cleavage is parallel to the bedding in the interbedded quartzite and probably reflects the attitude of the bedding throughout most of the gneiss. Dips throughout much of the area are gentle, and the strike is irregular. Small folds are apparent in the gneiss, but no large folds were found. Lineation is pronounced on most of the cleavage surfaces.

Two sets of joints, one trending N. 30° W. and the other N. 50° W., cut the gneiss. Along each trend the joint planes dip steeply to both the northeast and the southwest at angles of 20° to 30° from each other, and as a result the gneiss weathers into elongate rhomb-shaped blocks. The trend of the barite veins is similar to that of the joints.

Barite Veins. Three main veins, several lesser veins, and many small branches of these veins contain barite at the Barium Queen mine and vicinity. The main veins—east, middle, and west—follow faults that displace the gneiss and the marble. The horizontal displacement along the faults is about 100 feet. The east vein is continuous for 3,400 feet, the middle vein for 6,200 feet, and the west vein for 4,800 feet. The veins parallel the joints in the gneiss, following first one set and then another, and thus have many changes of attitude. On the small-scale map (pl. 2) and on the surface, these changes of trend appear angular and abrupt, although in reality many are curved and gradual, as is shown on the detailed map and sections (pl. 2). The veins are composed primarily of quartz and barite. In some places the veins consist entirely of either quartz or barite, and in other places the two minerals are intermixed so that the width of the vein at any particular place does not necessarily reflect the amount of either mineral present. The vein matter is in many places accompanied by fault gouge, but little of the barite is brecciated. The process of vein formation during the stage of the introduction of the bulk of the barite seems to have been essentially the filling of a fissure without accompanying fault movements. The age of the barite veins in the immediate vicinity of the Barium Queen mine is not known, but the veins are similar mineralogically to a system of veins cutting rocks of probable Miocene age in the Lead Mountain district 2 miles southeast.

The middle and the east vein each contains important amounts of barite. Along most of the exposed length of the middle vein the barite is more than a foot thick.

West of locality A (pl. 2) a 100-foot segment of the vein contains barite that averages 10 feet in thickness, and a considerable part of the rest of the vein contains barite that is between 3 and 5 feet thick. Six segments in the middle vein range from 400 to 1,000 feet in length and contain barite that averages from 1 to 10 feet in thickness. The east vein is more uniform in thickness, and the barite content can be described more simply. The 1,800-foot segment from the Barium Queen mine to the sharp bend near the north end of the vein contains barite that averages 2 feet in thickness. The part of the vein north of the sharp bend on the north side of the ridge and the part southeast of locality A (pl. 2) are too thin to be commercially important.

Workings. All three of the main veins have been explored and prospected, but the principal production of barite was from the Barium Queen mine, which is on the east vein. This mine consists of a drift 310 feet long, a winze 16 feet deep near the face of the drift, and two small stopes, one 16 feet long and 20 feet high and the other 23 feet long and 29 feet high. In addition to the main workings, four open-cuts and two shafts have been dug on the east vein. A shaft about 40 feet south of the Barium Queen mine is 24 feet deep, and another in section 22, on the north side of the ridge, is about 20 feet deep. The workings on the middle vein consist of four open-cuts and two shafts, 20 to 30 feet deep; barite has been recovered from the two cuts just south of the stream course near the north edge of the mapped area. The workings on the west vein consist of four small open-cuts and, just south of the ridge, one 20-foot shaft.

Reserves. Neither the west vein nor any of the shorter veins in the vicinity contain sufficient barite to be economically important at present; however, both the middle and the east veins contain appreciable reserves of minable barite. In the middle vein the barite has been uncovered by prospect shafts only to depths of 20 to 30 feet. Within the east vein barite probably is present from the ridge north of the Barium Queen mine to a depth of at least 200 feet, where it would intersect the projection of the deposit at the level of the mine. In the surface exposures of the veins, however, the barite is not consistent in thickness nor is it continuously exposed; hence the barite content of the veins at depth cannot be estimated accurately.

HANSEN BARITE DEPOSIT AND VICINITY

The Hansen barite deposit is 3½ miles northwest of Ludlow, in sec. 30, T. 8 N., R. 8 E., San Bernardino County, California (fig. 1). It is at the extreme southeastern tip of the Cady Mountains and can be reached by a dirt road that branches from the highway half a mile west of Ludlow. In 1943 the property consisted of four unpatented claims held by Harry Hansen, now deceased, of Ludlow.

The deposit has been described by Bradley (1930, pp. 54-55) and Tucker and Sampson (1930, p. 298; 1931, pp. 371-372; and 1943, p. 509) in reports of the California Division of Mines.

Geology. The rocks in the vicinity of the Hansen deposit are part of the series of interbedded volcanic rocks, tuff, sandstone, limestone, and siltstone that constitute

the lowest exposed unit of the Tertiary section in the southeastern part of the Cady Mountains, and are thought by Hewett to be Miocene in age (Moore, B. N., Hewett, D. F., et al., 1931, p. 150). The rocks in the immediate area of the barite deposits (pl. 3) consist of olivine basalt flows overlain by volcanic breccias, tuffaceous sandstones, and conglomerate.* Andesite, though not exposed in the mapped area, crops out and overlies the basalt 4,000 feet to the northwest. The basalt is a brown vesicular and amygdaloidal rock that forms flows 3 to 10 feet thick. It is black on weathered surfaces. The tuffaceous sandstones overlying the basalt are thin-bedded, bright red to bright green, and 75 to 100 feet thick. Volcanic breccias overlie the sandstones or, where the sandstones are absent, rest directly on the basalt. The breccias are well-indurated, massive-bedded rocks that weather to brownish-black and black cavernous surfaces. They are composed of red, brown, and black basalt and andesite blocks, as much as 5 inches long, in a matrix of ash. The thickest exposed section of the breccias, one in which the top has been eroded and the base is not exposed, is more than 150 feet thick. Quaternary alluvium overlies the bedrock at the lower altitudes.

The structural features of the area are similar to those of the rest of the Cady Mountains. Numerous faults cut the mountains; one of them has a trend that when projected passes under the alluvium at about 600 feet south of the Hansen mine. This fault, a reverse fault with a southwest dip, is exposed 3,000 feet west of the deposit and can be traced for several miles to the northwest. The small hill in which the deposit lies is cut by many smaller faults, only the most conspicuous of which are shown on the map. Barite occurs as fissure fillings where these faults cut the basalt. Similar barite veins occur in other parts of the Cady Mountains, though none so far observed are thick enough to be economically important.

Two fault systems are present: a dominant system with a northwesterly trend within which the strike of the individual faults ranges from N. 10° W. to N. 40° W.; and a subordinate system of faults that trend N. 10° to 30° E., terminate against, and in some cases, offset the faults of the dominant system. Several additional faults do not fall within the above systems. The attitude of some of the faults in the dominant system could not be determined, but of those that were measurable all but one dip steeply east. The exception is a fault in the Hansen mine, which dips 70° W. Some of the small barite veins, which probably follow faults, also dip to the west. Nearly all of the faults of known attitude are normal faults, but important strike components of their displacements may exist. The second fault from the west end of section A-A' (pl. 3), probably typical of the larger faults in the mapped area, has a displacement of about 230 feet.

Barite Veins. Barite occurs as fissure fillings in both faults and fractures closely associated with these faults at the Hansen deposit. Most of the veins that have not been mined are 1 to 2 inches thick, although a few are as much as a foot thick. Those veins from which barite has been recovered averaged 3 to 5 feet in thickness and locally reached a maximum of 11 feet. The veins are discontinuous and cannot be traced for more than a few

hundred feet. In some places, such as in the first ravine northwest of the Hansen mine, they are short and closely spaced.

The barite in the veins occurs as reddish-brown lamellar aggregates, with individual plates up to 3 inches in diameter, coated with iron oxide and quartz. The veins are in part banded, as shown by different degrees of iron-staining and different crystal sizes that resulted from two successive periods of deposition. Parts of some veins and the adjacent wall rock have been brecciated and are recemented by iron-stained barite, and as a consequence basalt fragments are included in the veins.

Four main barite areas have been worked, all of which are in or associated with well-defined faults in the basalt. The Hansen mine was developed in the northwest-trending vein along the most westerly fault at the south end of the hill (pl. 3). Before it was mined the vein was exposed discontinuously for about 300 feet along the surface; in several places it thinned or tapered out for short distances. The southeast end was covered by alluvium, and the northwest end was terminated by a fault. The thickness and attitude of the vein varied with depth. The richest part, now stoped, averaged 4½ feet in thickness, with a maximum of 11 feet, and was exposed for 120 feet at the surface; underground, however, the vein dipped more steeply, tapered to 1 foot in thickness, and was followed for only 80 feet. The attitude and size of the vein were controlled by the fault pattern, and the thickest part of the vein was localized at a flattening of the dip and a change in trend.

Barite fills the next two faults east of the Hansen vein that comprise the second and third barite areas. The vein adjacent to the Hansen vein is exposed for a total length of 70 feet on the surface; in two shallow trenches it has an average thickness of about 4 inches. The second vein east of the Hansen vein is discontinuous and crops out in two main segments. The southeast segment is about 60 feet long and tapers at both ends and with depth. The width of the vein at the surface is 3 feet, but at the bottom of an exploratory shaft, 50 feet deep, the vein is only 2 feet thick. The northwest segment of the vein is exposed for 55 feet in an open-cut, where the maximum thickness of the barite is 4 feet. Northwest of this exposure the vein, though discontinuous, can be traced for a distance of 500 feet, but nowhere is the barite more than 1 foot thick, and in most places it is less than half a foot.

The fourth area in which the barite has been partly developed is in and near the short spur 700 feet east of the Hansen mine. In the west trench a short vein of barite 1 foot thick is exposed. In and near the other open-cuts to the east a series of small barite veinlets occur in a breccia zone. The maximum thickness of the barite here is 2 feet, and the length is about 100 feet. Barite also occurs in thin short stringers between the two north-trending faults in the east side of the spur. The combined thickness of these veinlets is about 2 feet.

Workings. The date of discovery of the barite at this deposit is not known, but most of the development and mining took place between 1927 and 1930. From 1930 to 1952 little work was done, and no shipments of barite have been reported. The main development and recovery have been made along the vein on the southwest side of the hill. A drift was driven along the vein for 210 feet.

* For a generalized geologic map to the southeastern part of the Cady Mountains see: Durrell, Cordell, Geological investigations of strontium deposits in southern California: California Div. Mines Special Rept. 32, 1953, pl. 8.

The vein was then stoped to the surface, a vertical distance of about 50 feet, and a raise was driven from the northwest end of the drift. A total of 60 carloads of barite is reported to have been shipped from these workings. The stopes are now caved, and the raise is inaccessible. A 50-foot inclined shaft was sunk on the vein 100 feet east of the mine, but little barite was mined. Other than the above workings, shallow trenches and open-cuts along some of the smaller veins comprise the development of the deposit.

Reserves. The barite in the veins of the Hansen deposit is siliceous and highly iron-stained; hence it could be used only for those purposes for which purity is not of primary importance. The thickest and longest vein segment, that explored by the workings of the Hansen mine, has already been mined to a depth of about 50 feet. On the floor of the main drift the barite averages 2 feet in thickness for a distance of 50 feet; however, the vein tapers and may pinch out within a few feet below the drift. The 80-foot vein segment exposed north of the mine contains barite that averages 2 feet in thickness. The vein about 100 feet east of the Hansen mine contains the only other appreciable amounts of barite. The southeast segment is about 60 feet long and at the surface has an average thickness of 3 feet; the northwest segment is 55 feet long and 2 feet thick. The southeast segment tapers with depth. The total known barite content of the above veins is such that the minable reserves of the deposit are small.

BARITE DEPOSITS AT THE LEAD MOUNTAIN MINE AND VICINITY

The Lead Mountain mine is about 6 miles east of Barstow, in sec. 36, T. 10 N., R. 1 W., San Bernardino County, California (fig. 1). The mine is on the south side of Lead Mountain and can be reached by a dirt road that branches from the highway at a point about 2 miles east of Barstow. In 1945 the mine was owned by the Pacific Base Metals Co., of Los Angeles.

Brief descriptions of the mine are given by Tucker (1924, p. 297-298) and Tucker and Sampson (1930, p. 98; 1931, p. 372; and 1943, p. 484) in reports of the California Division of Mines.

Geology. Lead Mountain is composed of tuffs, thin interbeds of sedimentary rocks, and sills of diabase and syenite (pl. 4). Only one of the interbeds, a limestone, is shown on the map. This limestone, a dark-gray to brown porous rock with vague algal structures, is exposed in the southeast corner of the mapped area. The rocks are Tertiary and are overlain by small patches of Quaternary alluvium.

The tuff is highly altered, and much of it has been silicified. The unsilicified tuff is a soft light-green rock composed principally of clay minerals and chlorite with included fragments of quartz-rich rhyolite. The original plastic texture and stratification in the unsilicified tuff are barely recognizable.

The silicified tuff is dark red, probably owing to the staining by iron oxide introduced at the time of silicification. Stratification is more pronounced in this rock. The silicified rock is composed of a sequence of massive coarse-textured tuffs in beds about 20 feet thick interbedded with a thick- to thin-bedded tuffaceous sandstone

and shale. An interbedded conglomerate about 10 feet thick is exposed in the footwall of the main vein at the east end of the mountain, and thin interbedded red shales are exposed in the tuff at the east end of the mapped area. The combined thickness of the silicified and unsilicified tuffs and interbeds is unknown; however, about 500 feet is exposed within the mapped area. The age of the tuffaceous beds of Lead Mountain is not known, but the beds closely resemble the tuff members in the lower beds of the Barstow syncline that are generally considered to be Miocene in age.

The rocks in the vicinity of the Lead Mountain mine appear to be in a zone of irregular folds, complicated by faulting, and have no pronounced trend, although the rocks both north and south of Lead Mountain trend eastward. The most important fault of the area is that which contains the main vein. It is exposed at many places along Lead Mountain, and the strike changes from N. 50° W. at the west end of the mountain to N. 25° E. at the east end, where it curves about the south and east sides of the ridge. On the map (pl. 4) the west end of the fault is shown as terminating against a cross fault. Although the main fault is not exposed past this place, it probably continues farther west. The east end of the main fault passes under a cover of slide rock and alluvium. The main fault is believed to be a reverse fault. A large fault in the southeast corner of the mapped area cuts off a diabase sill. This fault, apparently extensive, cannot be followed farther than is shown on the map. The north side of this fault has moved down relative to the south side. Many smaller faults, including the cross faults offsetting the main vein, are exposed in the area, but only a few of them are shown on the map. Most of the faulting probably took place during or after folding.

Barite Veins. Barite occurs as a fissure filling in the main east-trending fault on Lead Mountain and in the related and closely spaced fractures in the hanging wall of this fault. Many small veins that cut Tertiary and older rocks in the vicinity of Lead Mountain, but beyond the area mapped, also contain barite, though not in sufficient quantities to be economically important. The barite along the main vein crops out for 310 feet and before mining was 8 to 18 feet thick. In depth the vein narrowed so that where exposed in mine workings 145 feet beneath the outcrop it was only 2 feet thick. Oxidized silver, lead, and zinc minerals associated with the barite were mined from a zone that extended for 120 feet along the vein and may have extended to the same depth as the barite. Barite veins in the hanging-wall fractures are several feet to 30 feet thick, and although these veins thin along the strike, several are more than 400 feet long. The hanging-wall veins dip more steeply near the center of the mountain; they may converge at depth, as shown in section B-B' of plate 4.

The vein along the east-trending fault was formed during several stages of deposition interrupted by recurrent movement along the fault. Silicification of the hanging-wall tuff and deposition of massive, fine-grained, brown iron-stained quartz occurred first. The silicified tuff and quartz were shattered and brecciated by subsequent movement along the fault. Resultant fractures, both along the main fault and in the silicified tuff, were filled by coarse-grained, coarsely banded calcite colored brown by included iron oxide. The calcite

is shown on the underground map as brown carbonate vein matter. Again movement occurred, and more extensive openings were formed near the center and at the east end of the fault. Barite, in small basal tablets, was then deposited in fine bands along the main fault and in the fractures in the silicified tuff, in some places replacing the earlier brown carbonate vein matter. Sphalerite, galena, and silver minerals, accompanied by small amounts of quartz and calcite, were deposited contemporaneously with and just after the barite. The vein minerals then were stained by iron oxide, and the ore minerals subsequently were oxidized.

Workings. The Lead Mountain mine was one of the mines in the vicinity of Barstow that were exploited between 1880 and 1890 for silver. After this brief period of activity, it remained idle until 1931, when it was operated for the recovery of barite. Since 1933 it has been inactive.

Accessible mine workings consist of an adit, driven from the south side of the mountain, that intersects the vein about 90 feet below the surface, inclined stopes for about 140 feet along the vein that extend to the surface, and a 55-foot winze from the bottom of one of these stopes that connects with a raise now inaccessible. The raise is believed to join a deeper adit 250 feet below the bottom of the winze, but this deeper adit is caved.

Reserves. Barite is exposed along the main vein for 310 feet and, although the vein narrows with depth, the barite extends for 160 feet down the vein near its cen-

ter. Some barite has been mined from the main vein, but a considerable tonnage still exists. The barite in the hanging-wall fractures has not yet been exploited. Barite is exposed for several hundred feet along the outcrop of several of the larger fractures and in places averages 10 feet in thickness. Although these fractures probably converge at depth, considerably more barite exists in the fractures than in the main vein; further exploration seems justified.

All of the barite is impure. It contains iron oxide, silica, calcite, and minor amounts of oxidized zinc, lead, and silver minerals. The barite may be of commercial value for purposes where purity is not of primary importance.

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